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FISH INDUSTRY DEVELOPMENT PATTERNS IN ASIA AND THE PACIFIC

Background paper*

Prepared by the

UNIDO Secretariat**

* This document has not been edited.
** Based on the work of David B. Thomson, UNIDO Consultant.

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INTRODUCTION

UNIDO has applied a systems approach to analysis of industrial patterns in a number of sectors including agriculture machinery, fertilizers, pesticides, oils and fats, and fisheries. In 1986 a global typology* of fish industry development patterns was achieved by an analysis of 21 variables grouped in 9 components.

The variables and components were selected in a way so that as a set they defined the complex fisheries industrial system taking into account all the fish industry related resources, industrial inputs, consumption components and the institutions and policies that affect them and influence their interaction in an integrated and interdependent manner.

The resulting computer analysis was extremely helpful in grouping countries with similar FIS development patterns, and this made possible selection of strategies on a global basis. Some of the results were applied in regional fish industry programme missions, particularly in West Africa and the South Pacific. But it was then concluded that a continental or regional typology would be more useful as the global picture tended to obscure some important regional issues. Accordingly a fish industry typology for 48 African countries was undertaken in May-June 1991 and proved to be illuminating for FIS development in that continent.

It was then deemed useful to undertake a similar study for Asia and the Pacific, to be completed in time for the UNIDO fish industry consultation meeting to be held in Vienna in late 1991. The work was undertaken by PDSU, the Programme Development Support Unit, in July-August 1991.

For the study it was decided to include all of the Asia and the Pacific countries in the FAO statistical yearbook with catches in excess of 10,000 tons a year. This incorporated 30 countries ranging from Turkey on the border of Europe to Fiji in the South Pacific.

Data was collected on 18 variables for those countries, reduced to 12 components. After initial testing it was found that variables 7 and 12 which gave values for government policy towards the FIS, and imports of FIS products,

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*Industrial Development Strategies for Fishery Systems in Developing Countries, Sectoral Studies No. 32. UNIDO. 3 April 1987.

respectively, were not assisting the analysis. Other variables were tested and retained. The programme was then run with 10 components made up from 15 variables. The resulting "average linkage cluster" analysis was accepted as providing the clearest picture of FIS development patterns. From its results emerged 4 main patterns and 12 sub-clusters which are described in detail in the report.

Readers should bear in mind that the analysis describes only the fish industries sector. It in no way describes the countries as a whole. A country may have an advance petroleum industry and a poor fishery sector or a well developed fishery sector and a poor general industry sector. All comments and proposals should be understood with regard to the fish industry sector only. No conclusions on the economic state of other sectors should be made from the report.

Note: In this paper the term "industrial" refers to the fishery activities which involve a degree of harvesting, manufacture, processing or servicing with modern machinery or equipment in an organised system whether private sector or state owned. It therefore excludes the traditional or artisanal sector where that does not involve some degree of mechanisation.

In FAO fishery papers "industrial fishery" normally refers to the exploitation of fish resources for reduction to oil and meals for animal feed. The term is not used with that meaning in this paper.

ASIA-PACIFIC AND WORLD FISHERIES

The developing countries of Asia and the Pacific contain more than half (56%) of the world's population. Their combined production of fish food is 32.4 million tons or some 33 per cent of the world total. As most of the Asian/Pacific fish goes for human consumption, their production of food fish is 43 per cent of the world total.

About 8 per cent of the Asian/Pacific catch is exported and this realises over ten billion dollars a year. Since some fish products are imported, the net trade balance in fishery commodities is $6.5 billion a year in Asia/Pacific's favour.

Since the region has such a high population, employment benefits are of great value and in this report the fishery industries are important as they provide work for ten million artisans, (6.8 million in capture fisheries and 3.9 million in culture fisheries). In addition, the sector provides work for some 10.0 million persons (mostly women) in processing and retail industries. Boatbuilding, marine engineering, ice manufacture, transport, fishing gear and other service industries probably account for another one or two million jobs. That gives a total employment of about 22 million persons in the fishery sector in Asia and the Pacific. If each wage earner is supporting a family of 4 or 5 persons then some 100 million people are directly dependent on the fish industry sector.

TABLE 1: ASIA AND PACIFIC MAIN FISH PRODUCERS

COUNTRY	POPULATION	PRODUCTION IN M. TONS (1989)
CHINA	1,117,173,000	11,219,990
INDIA	836,340,000	3,618,900
KOREA R.	43,100,000	2,832,400
THAILAND	54,900,000	2,822,500
INDONESIA	177,800,000	2,700,000
PHILIPPINES	60,790,000	2,096,787
KOREA D.P.	22,400,000	1,700,100
VIETNAM	65,660,000	868,000
BANGLADESH	112,585,000	832,790
MYANMAR	40,790,000	702,700
MALAYSIA	18,940,000	608,960
TURKEY	54,660,000	457,116
PAKISTAN	118,873,000	445,300
IRAN	54,870,000	259,750
HONG KONG	5,770,000	242,680
SRI LANKA	17,030,000	207,400
OMAN	1,430,000	107,000
UNITED ARAB EMIRATES	1,550,000	91,160
YEMEN*	10,192,000	72,850
MALDIVES	208,000	71,240
KAMPUCHEA	8,050,000	70,000
SOLOMONS	300,000	57,000
SAUDI ARABIA	13,601,000	53,390
KIRIBATI	70,000	53,100
FIJI	710,000	32,800
PAPUA NEW GUINEA	3,700,000	25,240
LAOS	3,960,000	20,000
IRAQ	18,300,000	18,150
SINGAPORE	2,674,000	12,610
NEPAL	18,690,000	12,520

*Combined figures for North and South Yemen before unification.

TABLE 2: ASIA AND PACIFIC FISH EXPORTS, IMPORTS AND CONSUMPTION

COUNTRY	EXPORTS IN $000	NET FISH IMPORTS* IN TONS	PER CAPITA FISH CONSUMPTION
THAILAND	$ 1,959,427	-	23.1 KGS.
KOREA R.	1,538,408	-	59.0
CHINA	1,392,904	187,000	10.0
INDONESIA	832,712	-	15.0
HONG KONG	687,686	50,000	42.0
PHILIPPINES	409,879	94,000	34.5
INDIA	391,596	-	4.3
SINGAPORE	359,071	63,000	4.9
MALAYSIA	209,610	50,000	33.0
VIETNAM	199,560	-	12.8
BANGLADESH	162,357	-	7.1
PAKISTAN	102,228	-	1.1
TURKEY	69,214	-	8.8
KOREA D.P.	68,175	-	65.0
IRAN	53,705	62,000	5.8
OMAN	47,930	-	25.8
SOLOMONS	38,444	-	66.0
FIJI	35,230	11,000	46.0
MALDIVES	30,480	-	190.0
SRI LANKA	23,412	4,000	14.0
YEMEN	17,050	-	7.0
MYANMAR	15,900	-	17.0
UNITED ARAB EMIRATES	11,929	5,000	19.7
PAPUA NEW GUINEA	10,069	36,000	16.7
SAUDI ARABIA	8,999	45,000	7.2
KIRIBATI	1,490	-	230.0+
IRAQ	-	-	1.0
KAMPUCHEA	-	-	8.7
LAOS	-	-	5.0
NEPAL	-	-	0.7

*Food fish trade negative balance (excludes fishmeal and oil).

FISH INDUSTRY PATTERN ANALYSIS

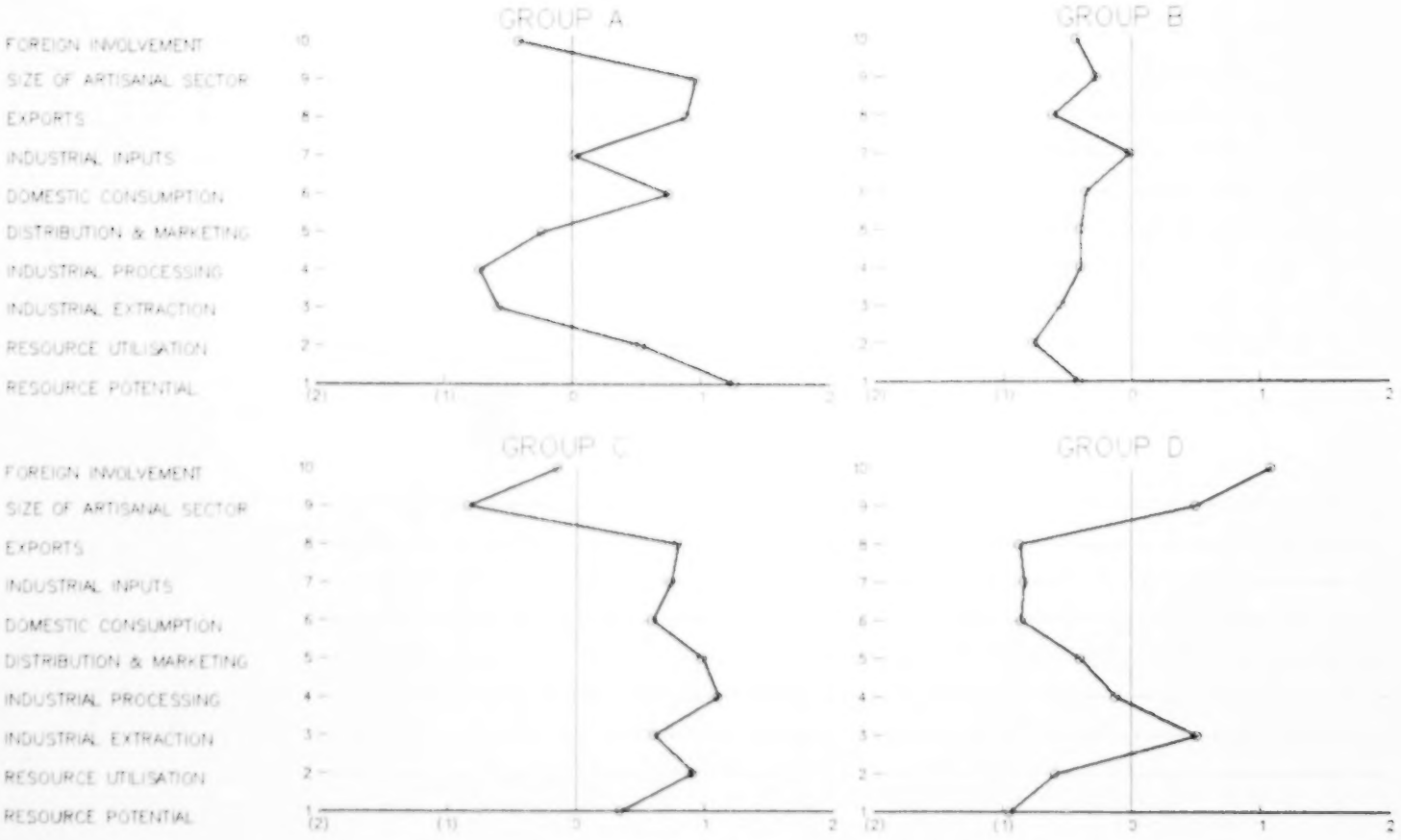
The computer programme analysis indicated four major patterns of fish industry development in Asia and the Pacific. While each country and each industry faces a particular set of constraints and enhancements, there are commonalities that link the states in each of the major groups. Group A has a colossal domestic market and large fish production to meet that need. Group B countries have a less developed fishery sector and are not yet utilising their resource to the full. The fish industries in Group C are well developed, very commercial or productive, and heavily export-oriented. Group D countries are small with limited domestic markets and consequently less exploited fisheries.

All four groups have enormous potential in FIS though they face differing opportunities and obstacles. These are discussed more fully in the part on constraints and enhancements. Below is a general description and analysis of the four major patterns.

ASIA AND PACIFIC
FOUR MAJOR PATTERNS OF FISH INDUSTRIES

GROUP A Huge domestic markets and large artisanal fisheries with substantial aquaculture element and growing industrial/export sector	China, Philippines, Indonesia, India, Bangladesh, Vietnam
GROUP B Relatively under-utilised resource and limited development of fish industry sector due to other priorities or problems.	Iran, Yemen, Myanmar, Oman, United Arab Emirates, Papua New Guinea, Sri Lanka, Iraq, Saudi Arabia
GROUP C Commercial and export oriented fish industry sectors, good degree of industrialisation and processing, high internal fish consumption.	Korea R., Thailand, Hong Kong, Singapore, Malayasia, Turkey, Pakistan, Korea D.P.
GROUP D Small island and inland fisheries, limited size of domestic market, some exportable marine resources.	Fiji, Solomons, Kiribati, Maldives, Kampuchea, Laos, Nepal

GROUPS PROFILES—ASIA



VARIABLES USED IN THE ASIA-PACIFIC FIS STUDY

V1a Fishery Resource Potential
Indication of total resource size vis-a-vis population size.

V1b Resource Utilisation
Percentage of resource harvested by the national fleet.

V2 Industrial Extraction
Degree of harvesting undertaken by industrial fleets.

V3 Industrial Processing
Percentage of catch processed industrially (i.e. not artisanally).

V4 Distribution and Marketing
Assessment of extent, efficiency and quality of distribution and marketing.

V5 Domestic Consumption
Size and potential of domestic market (function of per capita consumption and population size).

V6 Industrial Inputs
Indication of the extent and efficiency of supporting industry and infrastructure.

V9 Fish Exports
Value of fish exports relative to country size.

V11 Size of Artisanal Sector
Importance of small scale sector vis-a-vis country and fish industry.

V13 Foreign Involvement
Degree of foreign ownership or participation in FIS.

Note: Variables V7, V8, V10 and V12, namely government's role in FIS, government's ownership in FIS, KW per capita generation, and fish food imports, were tested and discarded as unhelpful to the study. Computer analysis of the variables indicated that they duplicated information discernible from other variables.

TABLE 3: STANDARDISED VARIABLES

	V1a	V1b	V2	V3	V4	V5	V6	V9	V11	V13
BANGLADESH	0.586	0.8683	-1.192	-1.141	-0.917	0.439	-0.710	0.1792	0.838	-0.621
VIETNAM	0.859	-0.560	-0.795	-0.901	-1.131	0.61	-0.324	0.4819	0.3681	-0.621
INDIA	1.474	1.198	-1.192	-0.901	-0.775	0.7811	-0.131	0.709	1.0719	-0.459
INDONESIA	1.405	0.5386	-0.795	-0.820	-0.632	1.1231	0.4466	1.3146	1.1512	-0.137
CHINA	1.951	0.1758	0.6957	-0.740	0.5801	1.8073	0.1574	1.9202	1.4645	-0.621
PHILIPPINES	1.269	0.9782	-0.198	0.1417	1.4359	-0.245	0.6394	0.709	0.838	-0.056
GROUP A	1.257	0.5330	-0.579	-0.727	-0.240	0.7525	0.0128	0.8856	0.9552	-0.419
IRAN	0.109	-1.329	-0.695	-0.098	-0.632	-0.416	0.3502	-0.275	-1.354	-0.540
YEMEN	-0.23	-2.099	-0.397	-0.580	-0.489	-0.587	-0.131	-0.577	-0.023	-0.459
MYANMAR	0.859	-1.22	0.0994	-0.419	-0.061	0.61	-0.035	-0.577	0.2898	-0.459
OMAN	-0.43	-0.890	-0.496	-0.580	-0.561	0.0969	-0.228	-0.275	0.9163	-0.298
UNITED ARAB EMs	-0.64	-0.230	-0.397	-0.179	-0.632	0.268	-0.228	-0.502	0.1331	-0.298
PAPUA NEW GUINE.	-0.91	-1.000	-1.093	-1.141	-0.846	-0.929	-0.035	-0.653	0.7597	-0.459
SRI LANKA	-0.36	0.7584	-0.397	-0.419	0.3661	0.0969	-0.324	-0.577	-0.180	-0.459
IRAQ	-1.25	-0.450	-0.894	-0.820	-1.202	-1.613	0.0611	-1.334	-1.668	-0.701
SAUDI ARABIA	-0.84	-0.450	-0.695	0.623	0.4374	-0.758	0.4466	-0.729	-1.354	-0.217
GROUP B	-0.41	-0.768	-0.552	-0.401	-0.402	-0.359	-0.013	-0.611	-0.275	-0.432
HONG KONG	-0.30	1.3079	0.5963	0.8636	1.5072	0.268	0.543	1.1632	-0.963	-0.298
SINGAPORE	-1.32	0.8683	-0.496	0.4626	1.2933	-0.416	0.543	0.6333	-1.198	0.0242
KOREA D.P.	1.132	0.8683	0.8945	0.7032	0.2948	1.8073	0.1574	-0.123	-0.885	-0.459
MALAYSIA	0.313	0.4286	0.1988	0.5428	0.4374	0.7811	0.2538	0.2548	-1.041	-0.217
TURKEY	0.245	-0.120	0.8945	1.5855	1.3646	0.0969	0.8322	-0.123	-1.354	0.0242
PAKISTAN	0.040	1.0881	0.3975	1.8262	-0.275	-0.758	0.0611	0.1035	0.1331	-0.298
KOREA R.	1.337	1.4178	1.3914	1.3449	1.6498	1.9783	1.7962	1.9959	-1.198	-0.137
THAILAND	1.337	1.4178	0.9939	1.5053	1.5785	0.9521	1.6998	2.3744	-0.258	0.1855
GROUP C	0.348	0.9094	0.6087	1.1042	0.9812	0.5886	0.7358	0.7847	-0.845	-0.147
FIJI	-1.11	-0.120	0.6957	0.8636	0.6514	-1.100	0.6394	-0.350	-0.885	2.1211
SOLOMONS	-0.77	-0.670	1.8883	1.1042	0.5087	-0.587	0.4466	-0.350	-0.806	2.2824
KIRIBATI	-0.98	-1.439	2.584	1.024	0.4374	-0.245	0.3502	-0.956	0.5247	2.8470
MALDIVES	-0.57	-1.110	1.292	0.5428	0.2948	0.268	0.2538	-0.426	0.9946	2.4437
KAMPUCHEA	-0.57	-1.22	-0.894	-1.462	-1.559	-0.758	-2.445	-1.334	1.1512	-0.701
LAOS	-1.25	-0.120	-0.695	-1.462	-1.559	-1.955	-2.541	-1.334	1.3079	-0.701
NEPAL	-1.32	0.5386	-1.292	-1.462	-1.559	-1.613	-2.541	-1.334	1.2295	-0.701
GROUP D	-0.94	-0.591	0.5111	-0.121	-0.398	-0.855	-0.834	-0.869	0.5023	1.0841

ASIA AND PACIFIC
SUB-CLUSTERS OF FIS PATTERNS

GROUP A	A1	CHINA
	A2	INDONESIA, INDIA, BANGLADESH VIETNAM
	A3	PHILIPPINES
GROUP B	B1	IRAN, YEMEN, MYANMAR
	B2	OMAN, UNITED ARAB EMIRATES
	B3	PAPUA NEW GUINEA, SRI LANKA
	B4	IRAQ, SAUDI ARABIA
GROUP C	C1	KOREA R., THAILAND
	C2	HONG KONG, SINGAPORE
	C3	MALAYSIA, TURKEY, PAKISTAN, KOREA D.P.
GROUP D	D1	FIJI, SOLOMONS, KIRIBATI, MALDIVES
	D2	KAMPUCHEA, LAOS, NEPAL

GROUP AND CLUSTER DESCRIPTIONS

Group "A" which has been already described as possessing a huge internal market, contains in its six countries 45 per cent of the world's population, or 52 per cent of the population of Asia and the Pacific (this excludes developed countries like Japan and Australia). Together their fish industries produce over 21 million tons of fish a year which is about two thirds of the Asian production and around a quarter of the world's food fish production. The group also has the largest artisanal sector in fisheries with some 8,700,000 fishermen and fish farmers. In exports it is the second largest of the 4 groups with a total annual value of $3,190 million from its foreign fish trade. The group is made up of three clusters. China and the Philippines are single country clusters. Indonesia, India, Vietnam and Bangladesh form the other cluster.

Cluster A.1. China is the largest fish producer in the region, and next to the USSR, is the world's largest fish producing nation, having surpassed Japan in 1989. It also has the largest domestic market for fish in the world, over one billion persons. But there are other unique features of the FIS in China apart from bigness. The fishery is nearly 50 per cent dependent on aquaculture systems and so it is the world's leader in the farming of fish.

Cluster A.2. Indonesia, India, Vietnam and Bangladesh have large artisanal fisheries and substantial internal demand for fish. Their combined populations number 1.2 billion and their combined production of fish is over 8 million tons a year. They also have a growing industrial fishery focussed on the export market. Indonesia is the largest and best developed and it earns over half of the group's export earnings of 1.5 billion. Indonesia also has the best developed and flourishing fish culture sector.

Cluster A.3. Philippines, combines a large artisanal fishery with a flourishing commercial sector and a substantial fish culture sector. It differs from clusters 1 and 2 in that its resource is more heavily exploited and has severe environmental problems. It has a higher degree of industrial fish processing and a somewhat better developed distribution and marketing system. Surprisingly, there is less foreign involvement in its fishery than in the others.

Group "B" contains nine countries with good to modest fish resources which are less than fully exploited. As the cluster group (figure 1) shows, it differs from group A in all but three points and from graph C in all but one. For various reasons the fish industry sector is not a major priority with the governments except perhaps in Yemen, Sri Lanka and Oman. While per capita fish demand is good in most of the group, the domestic market potential is limited, their combined populations totalling only 160 million. Although they are not involved much in foreign fish trade, the countries mostly have some export potential.

Cluster B.1. Iran, Yemen and Myanmar have good resources and a fairly strong local fleet base. For differing reasons in each country, the industry requires some reorganisation and an input of capital to upgrade capture, handling and processing facilities. Iran is of course, a major producer of caviar. Yemen and Myanmar produce mainly food fish and some shrimp. All three countries are investing heavily in fish industry training and support services.

Cluster B.2. Oman and United Arab Republics are neighbouring countries with similar fish industries. Both have a strong traditional fisheries sector, and substantial offshore fish stocks. They have the potential to develop both food fish and reduction (fish meal) industries. Their governments have been placing considerable emphasis on research and development of the fish industry sector.

Cluster B.3. Papua New Guinea and Sri Lanka have substantial fish resources and a strong artisanal sector. Sri Lanka's fishery has been developed steadily the past 30 years while PNG's development has been held back for various reasons. Internal political problems are restraining further FIS development in Sri Lanka at present. PNG has yet to implement an effective programme to exploit its large tuna resources in a beneficial way.

Cluster B.4. Iraq and Saudi Arabia, are two oil-rich countries where fisheries is a very minor economic activity. Iraq has very limited water resources, but Saudi Arabia has access to both the Red Sea and the Gulf. It has made good progress with the development of the Saudi Fisheries Company and the growth of small industry related to the sector.

Group "C" has the strongest commercial and industrial orientation of the four. It has eight countries whose combined export earnings total about $5 billion. This is from a total fish production of 9 million tons most of which goes to feed the combined population of over 320 million persons. Their industries are more capital intensive hence a relatively smaller fisherman population of about 1.35 million. The cluster graph (figure 1) shows clearly the positive industrial nature of the group.

Cluster C.1. Korea R. and Thailand are probably the strongest fish industry countries in the region in terms of fleet strength and processing capability. Korean vessels range as far as the Atlantic Ocean in search of fish and Korean companies engage in fishery joint venture all over the world. The country also has a strong shipbuilding and fishing equipment manufacture sector. Thailand has the largest tuna canning industry in the developing world and its exports dominate this market.

Cluster C.2. Hong Kong and Singapore are also commercially oriented fish industries though smaller. Singapore is the smallest as it has no sizable marine resource of its own and must import much. Hong Kong has both a good capture sector and a strong import/processing/export sector. Both these industries have important cured fish sectors producing dried, fermented, pickled and salted sea food products.

Cluster C.3. Malaysia, Turkey, Pakistan and Korea D.P. have good fishery industries but which are of minor economic importance nationally except perhaps in Korea D.P. Internal fish consumption is good in all four except Pakistan. About half of Pakistan's fish catch is reduced to fish meal for animal feed. All four countries have a good industrial base to support the sector and all four have healthy fish export trade.

Group "D" is composed of seven relatively small countries in two distinct clusters, one of island states and the other of inland or freshwater fishery countries. Both face development constraints of somewhat opposite nature. One has a large resource and limited domestic market and the other has a large internal demand but limited resource. The combined production at present is less than 300,000 tons so it is the smallest producer of the four groups by far.

Cluster D.1. Fiji, Solomons and Kiribati, are Pacific island states with sizeable tuna resources whose development is hindered by lack of capital and infrastructure and distance from markets. While they each have a coral reef fish and shellfish resource, it is vulnerable to over fishing and so is protected to provide only local food fish and tourist attraction. All three countries are currently developing tuna capture and processing in cooperation with foreign firms.

Cluster D.2. Kampuchea, Laos and Nepal are inland countries with relatively poor population which requires a low-cost supply of fish protein. Kampuchea has access to the sea at the Gulf of Thailand, but most of its fishery is in fresh water. Fish farming could be developed in all three states given stable conditions and some technology and capital inputs.

FIS CONSTRAINTS AND ENHANCEMENTS

The fishery industries of Asia and the Pacific are already flourishing and are well poised for further expansion. Their future appears to be good as it is likely that demand for fish products will rise more rapidly than supply. In assessing their constraints one has to bear in mind that these are relative. Most of the region's FIS problems are problems of growth and therefore indications of the dynamic in the industry. Also most of the constraints are ones that can be overcome given adequate attention so they are not serious threats to progress unless they are ignored.

Asia and the Pacific do not face the serious fishery resource problems of Europe or the Mediterranean countries. Neither do they have to labour under the enormous economic disadvantage of most African countries. Their fish industries can flourish on the basis of the internal demand alone, yet they have the opportunity to export surplus fish products to the value of over ten billion dollars and more. So relative to the rest of the world the constraints are not so serious.

Constraints

There are six major constraints which face the fish industry sector in Asia and the Pacific. They are:

i. Environmental problems.
ii. Supply of skilled and qualified technical and managerial personnel.
iii. Social aspects of artisanal fisheries.
iv. Access to distant and protected markets.
v. Delivery of credit and technology to FIS.
vi. Resource management.

C.i. Environmental problems. Serious destruction of the marine and coastal environment is reducing productivity of fishing grounds and if not halted, will continue to pose a threat to future fish production. The destruction has three main forms, namely: destruction of coral reefs by dynamite fishing, large reef net fishing, and harvesting for tourist markets; destruction of mangrove forests to make room for large fish farms, and for fuel wood; and pollution of inshore waters with poisons and inorganic matter, chiefly plastic bags. One of the worst affected countries is the Philippines where all three practices are still continuing. The Gulf of Thailand is also seriously affected and more recently the Arabian Gulf from the oil pollution and the effects of the burning oil wells.

Mangrove trees may be replanted on suitable sites, but once a coral reef dies it is not possible to "bring it to life" again. It remains an underwater cemetery, shunned by fish where once myriads of species congregated. Another source of pollution is the use of cyanide poisoning to collect exotic reef fish

for the aquarium industry. The poison stuns the fish and probably kills 50 per cent of them, but enough recover to make it financially profitable. But the cyanide itself remains in the sea where it could affect the corals and other marine life in the proximity. In some of the atolls of the Pacific, pollution by radio-active materials from nuclear explosions also poses a long-term serious threat to marine life and thus to humanity.

Environmental pollution is also a problem in fresh water fishery areas. The pollutants come from four main sources: deforestation causing soil erosion' chemicals and pesticides from agricultural activities; mining wastes and chemicals; and urban wastes. As a result, most surface waters are polluted to some degree and clean fresh water is a prime requirement for villages, fish markets, ice plants, fish plants, fish farms and hatcheries.

In several Asian countries, agricultural chemical use is now controlled to limit negative effects as at one time it was impossible to grow fish in flooded paddy fields as they all died from the presence of DDT and similar pesticides. But generally speaking mining and logging activities are not well controlled despite their obvious effects on the environment and both land and sea creatures. Use of dynamite and cyanide are prohibited by law in most countries but enforcement is weak or non-existent and the political will appears to be absent for control of this as for mining and logging.

C.ii. Supply of skilled and qualified technical and managerial personnel. Asia and the Pacific are making great strides in education and training but as yet there is a shortage of competent persons to fill senior posts in the fish industry sector. The need is most urgent in the managerial and technical disciplines. Business management and project management need more competent persons. There is also a shortage of marine engineers, processing engineers and fish quality control officers.

The region has invested substantially in new and expanded institutes for education and training. Unfortunately, the bulk of the investment by far has been in buildings and campuses. There has been much less investment in equipment or staff training and very little at all in teaching materials, textbooks and training aids. As a result while there is a large volume of graduates being produced, the general calibre is low. The Asian Fisheries Society examined the problem at a regional workshop where it heard from both industry and educational institutes. It concluded that a radical improvement in the practical and industry related parts of fishery education and training was urgently required.

C.iii. Social aspects of artisanal fisheries. The ten million or so small scale fisheries in Asia and the Pacific are an important group socially and strategically. They provide by far the bulk of the food fish for the region. They are also the economic base for thousands of coastal villages and communities, often in remote locations. Without them and their production, many of these villages would die and there would be increased rural-urban migration. But they are a disadvantaged group in many ways, lacking access to banking, technology and many social services. In many cases they have been exploited by merchants and money lenders since they have no independent access to markets or other source of capital.

Asian governments are now recognising the importance of this group and are making efforts to protect and assist them. Those efforts take many forms, three of which bear mention.

(a) Protection of their inshore fishing grounds. This can be some form of limit which excludes large commercial vessels, or better still, an allocation of a coastal zone property right so that each village has control and ownership of the inshore area extending seaward from the village.

(b) Integrated development programmes which seek to raise the production and living standards of fishing communities in a general way, addressing all production systems, village development, health and welfare.

(c) Fisheries extension services which seek to provide useful information, technology and access to credit. The latter may involve a requirement to form a cooperative or production group with its own internal discipline and guarantee system. The coops have had limited success but in fairness they tackle a difficult problem and are applied in societies not accustomed to democratic structures and previously not encouraged to make decisions about their own economic system.

Indonesia which has one of the largest fishermen populations in the world is endeavouring to address their social problems in several ways. It recognises two types of fishing community with distinct needs: those in remote parts of the country with good fish resources but poor access to markets; and those in more populated, heavily fished areas, who require help with conservation and more general integrated area development.

C.iv. Access to distant and protected markets. Most Asian/Pacific fish exports go ultimately to Japan, the USA, the Middle East and Europe with a smaller amount to countries in the region such as Hong Kong, Singapore, Papua New Guinea. The large distant markets such as Japan, USA and Europe are not easily accessed. Shrimp is the major export product, and during the early days of the growth of that industry many companies suffered losses when shipments were rejected or given very low prices because of poor quality. Quality control is still a major problem, but considerable advances have been made in that field. Tariff barriers are also a hurdle for exporters, especially for products with severe price competition. Canned tuna is an example of this. The global price for a carton of canned tuna (24 tins) varies around $22 to $26 and it is difficult to gain any price advantage without rigorous attention to efficiency and costs of inputs. In consequence, any extra cost whether in the form of a tariff or shipping charge, can greatly affect the profitability of the export.

Despite the above problems, some countries have made remarkable progress in fish exports. Thailand has become the developing world's largest exporter of processed tuna. Indonesia has added to its enormous shrimp exports, a growing tuna trade including airfreighting of fresh tuna for the lucrative sashimi market in Japan. Fiji is now importing mackerel from as far away as Chile, canning them, and re-exporting the product in the region.

C.v. Delivery of Credit and Technology to the FIS. Without investment and appropriate effective technology, no industry can grow or maintain competitiveness. For the larger fish industry companies this is not a major constraint since they have the banking and overseas industry contacts to access both capital and technology. But most of the fishery industry is made up of small-scale and medium-sized enterprises, often located in remote islands or coastal areas. For them both capital and technology are acquired with difficulty.

Generally speaking, the banking sector world-wide has regarded the fisheries sector with suspicion, as a high-risk area. This is not without justification for most of the large government-sponsored credit schemes to fisheries have been poor returns. On the other hand, fishermen complain that they are not treated with respect by lending agencies which can be bureaucratic and demand collateral and downpayments for in excess of their ability. Then loans are often awarded to non-genuine applicants who can better fulfill the conditions. National development banks have been established in many countries to address this problem but often they have proved to be poor vehicles for credit, influenced too much by bureaucratic and political factors and not sufficiently business minded. Many fisheries entrepreneurs prefer to go to commercial banks and pay a higher rate of interest for a loan which is delivered much more quickly and in an efficient manner.

Technology to improve fisheries is acquired in a number of ways, mostly informal. There have been relatively few fisheries trade fares in the developing countries, and it has not always been possible for small operators to hear of and attend them. Information is passed by word of mouth, by personal observation and through national or regional contacts. For example, the "power-pole" type of boat propulsion is used all over Southeast Asia. Thai boatmen used this in the rivers and canals, and later the system was adopted for small fishing boats. Soon it largely replaced the use of outbound motors since it was cheap and simple to install and maintain. No commercial promotion or government extension service was involved to any degree. On the other hand, the use of "Payaos" or Fish Aggregating Devices to attract tuna has been successfully promoted by a number of fishery extension services with support from agencies like FAO.

Inappropriate technology has hindered fishery development, being costly or fuel-expensive and sometimes unnecessarily replacing human labour. Sometimes it has been environmentally destructive as in the case of some industrial trawl gear and large drifting gill nets. Much work remains to be done to develop, select or deliver systems suitable for fisheries in the various parts of Asia and the Pacific. Of particular need are suitable solar fish driers, simple refrigeration or ice making machines (perhaps powered by steam or coconut oil engines or even solar cells). Vessel technology is an area with a long record of unfortunate design application. The need is to preserve and incorporate the best of traditional design with quality methods of construction using kiln-dried wood, non-corrosive fasteners and simple but effective mechanisation systems.

C.vi. Resource Management. The fisheries of Asia and the Pacific differ from those of the temperate northern waters in the variety of species. A handful of fish species from the bulk of the commerciall catches in Europe and North America. In the tropics the number of species is much greater, both pelogic and

demersal. A multi-species fishery creates greater management problems since it is not possible to isolate harvesting of one species from another except for special groups like tuna or lobster.

The problem is most severe in the coastal areas where the bulk of fishing activity takes place. Trawl net fishing can be particularly damaging if not strictly controlled, and this has led to a ban on such methods in Indonesia for example where the Java Sea fish stocks were greatly depleted.

Beyond control of undesirable fishing there is the need to enhance the resource by introduction of protected sanctuaries or breeding areas and use of fish culture or fish ranching systems. Construction of artificial reefs or fish habitats can help rejuvenate a depleted area. But all such improvements necessitate some legal measures to provide user-rights or ownership-control of coastal waters by local communities. Japan has shown how this can be achieved through its coastal fishery cooperatives in various prefectures, and some Asian countries are endeavouring to follow suit.

Enhancements

The fish industries of Asia and the Pacific have many advantages. The industrial dynamic of the Pacific basin and the emergence of new industrial powers in Southeast Asia has long been recognised. As the enhancements relate to the FIS, six major elements are worthy of mention.

i. Abundant resources
ii. Large or strong internal markets
iii. Traditional fishery skills
iv. Infrastructure and Services
v. Aquaculture skills and potential
vi. Openness to foreign cooperation.

E.i. Abundant resources. Practically all of the Asia/Pacific countries have either extensive and productive marine waters and substantial inland waters or both. The exceptions are dry inland countries like Afghanistan and Mongolia. Some tiny ocean countries have a large fish resource, like Kiribati or Maldives. Some states produce all of their fish food from fresh waters, such as Laos, Nepal and Cambodia (almost all). China has immense fresh water fish production.

The fertile waters of the Indian Ocean, the South China Sea and the West and South Pacific, together with their adjacent gulfs and bays, produce vast quantities of sardine, mackerel, tuna, shrimp, demersal and reef fish, squid and other edible fish or shellfish. While there are areas of over-harvesting and some species under pressure, in general the resource is healthy and could yield further production. This is important for fish industry development, both to meet growing domestic demand and to earn foreign currency from export markets.

E.ii. Large or strong internal markets. Asian and Pacific peoples are mostly fish-eating. Countries as far apart as Yemen and the Philippines consume more fish protein than other animal protein. Where the countries are large this creates an enormous internal market. China and India are good examples, though in Indian food consumption patterns vary greatly from region to region.

The large internal markets for fish mean that the industry can develop on the basis of the domestic demand alone even though export markets exist. There are a few small population countries (mainly in Group C) which can never have a large domestic market even though per capita consumption of fish is high. They need to focus on export markets for fishery industry development. But for most other countries, the domestic demand is an adequate motor for development.

E.iii. Traditional fishing skills. Asian and Pacific peoples have been harvesting the oceans and preparing fish products for centuries. They have in the process accumulated a vast amount of traditional knowledge and skill in the capture and preservation of fish. These artisanal skills should not be lost, but should be married to appropriate modern technologies to maintain the productivity and efficiency of the sector. National research and training institutes should utilise and build on the accumulated experience of generations past, and not discard it as if it had little value compared with western innovations.

E.iv. Infrastructure and Services. Practically all of the marine fishery countries in the study have already acquired the basic infrastructure of ports, roads, electricity generation, and service industries that are necessary to maintain fishing fleets and fish processing activities. Some have chosen in recent years to expand their FIS related infrastructure. Thus Indonesia has embarked on a major programme of fishing port development. Karachi is currently involved in one and the Philippines completed its own some years ago.

In all the main fish landing places, fuel, fresh water, ice, provisions and repair services are available and the presence of this support industry facilitates fleet expansion where required in most of the countries. Inland transport for fish distribution is well developed through most of the region as are shipping services for export products.

Exceptions to this include some remote coastal and island fisheries, but even there progress is being made. For less favoured fish landing places, supplies of clean water, ice, repair services and regular transport (land or sea) remain to be improved.

E.v. Aquaculture skills and potential. No other part of the world has such a concentration of skill, knowledge and experience of fish farming as Southeast Asia. China leads the way by far, providing five per cent of total world fish production, from its culture systems alone. Philippines, Indonesia and others also have substantial culture systems for fish, marine, brackish and fresh water although brackish water systems predominate.

As the farming of fish will become more important in view of the limitations of natural stocks, Asia and Pacific are well-placed to pursue this form of production. Much of current aquaculture in the region, outside of China, is export-oriented. Ponds which used to produce milkfish for local consumption

now produce shrimp for foreign markets. Mussels, oysters and seaweeds are also farmed. Chinese carp are cultured to meet good local restaurant demand. In the Pacific, efforts are being made to produce giant clam and pearl oyster, both for export.

Asia's world lead in the farming of fish is likely to continue and to increase in terms of number and intensivity of culture systems.

E.vi. Openness to foreign cooperation. Most Asian/Pacific countries have an open-door policy towards foreign cooperation. But this is tempered with strong national control of the domestic economy. In the fish industry sector foreign cooperation is most clearly seen in the export processing business. Apart from the small states which lack resources to mount deep sea fishing enterprises, practically all of the harvesting sector is in national hands.

Foreign assistance is still needed in certain areas. In the construction of deep sea fishing vessels, few of the countries are able to produce all of their requirement from national yards. But rather than import costly new vessels, many states are encouraging joint-venture between national and foreign shipyards to produce the ships locally with some foreign expertise.

The openness to foreign cooperation, with accompanying safeguards to prevent exploitation, is an asset to the region's fishery industries. Wisely applied, such cooperation can help the countries to assure finance, technology and training, and to gain access to overseas markets.

APPROPRIATE STRATEGIES FOR ASIA-PACIFIC FISHERY INDUSTRIES

In view of the FIS patterns identified by the study, and in the light of the constraints and enhancements described above, what useful strategies can Asia/Pacific countries follow to ensure balanced and profitable development of the sector? Certain issues are clear and are already being addressed by most of the countries concerned. Among these are fisheries management, quality control, socio-economic problems of the small-scale sector, and environmental concerns. As these major issues are common to some degree the relevant strategies and actions are discussed on a region-wide basis.

Region-Wide Strategies

S.i. Provide and maintain wise and effective resource management to ensure balanced sustainable harvesting and fair competition.

S.ii. Pay close attention to quality control at all levels, from capture to sale, to processing to retail sale or export, to reduce losses and to maintain profitability.

S.iii. Protect and support the small-scale sector in its harvesting, husbanding, processing and distribution activities, and in the general welfare of its villages and communities.

S.iv. Prevent and control all environmentally damaging activities in the marine and aquatic zones and encourage renovative or enhancement work wherever feasible.

Relevant Activities

A.i. Establish good basic information networks on all harvesting activities, fleet sizes and composition, gear types, catches and fishery areas. Promote and maintain good relations with the industry and involve owners and operators fully in discussions on control measures. Ensure effective enforcement of fisheries legislation with the co-operation of local authorities, industry leaders and some form of MSY-Monitoring, Control and Surveillance service.

A.ii. Provide clean water and shade at all fish markets and landing places. (Salt and fresh water may be used. SWS units can clean local water cheaply and effectively). Insist on vigorous washing procedures, daily, at all markets. Help owners to construct and maintain easily cleanable and insulated fish holds, and to carry ice. Improve number, production and efficiency of ice plants. Where state-owned plants are operating inefficiently, seek to privatise. Assist merchants and processors to achieve and maintain high standards in quality control. Support training for processing plant staff and management. Cooperate with foreign importers and with FAO in efforts to raise quality and increase added value.

A.iii. Provide effective enforcement of fishery regulations in coastal waters to prevent conflicts between operators of large vessels and to canoe fishermen. Work towards legislation which will provide local small-scale fishermen ownership or control rights over the coastal area adjacent to their village. Assist and encourage them to protect and enhance the environment and to move towards husbandry rather than hunting of fish. Support village or community based integrated development and welfare programmes.

A.iv. Put substantial effort into policing and control of destructive practices such as dynamite fishing, coral harvesting, reef netting, mangrove cutting and pollution. Increase penalties and strengthen inspection on owners, operators, suppliers and local authorities. Ensure that all logging contracts contain replanting and repair of landscape requirements incumbent on loggers. Strengthen inspection and control. Insist that all mining and heavy industries dispose of their waste in environmentally acceptable ways. Monitor waste discharges constantly. Provide strong leadership on environmental protection, from the highest levels of government to the lowest or most remote.

Group Specific Strategies - Group A

The major problem facing group A countries is how to continue to feed their large and growing populations which rely to a considerable degree on fish protein. Their current large production of fish will have to be increased much more to keep pace with the growing population. The second major problem is to continue to industrialise and upgrade the fish industry, particularly the export related sectors. This brings us to the following basic strategies:

A.S.i. Maintain and promote continued high production by effective management, spread of effort and through environmental controls.

A.S.ii. Promote efficiency and profitability in the production sector through careful choice of technology and monitoring of the energy and capital costs of the different production systems.

A.S.iii. Improve distribution and delivery of quality fish protein and work with schools and consumer groups to maximise nutritional benefits.

A.S.iv. Investment in added value processing and in support industries to increase exports value and reduce foreign currency costs. Utilise foreign cooperation or joint-venture arrangements where these are beneficial in terms of transfer of technology and improved national capability.

Relevant Actions - Group A

A.A.i. Develop an effective MSY service (Monitoring, Control and Surveillance) and draw industry into all decision-making on conservation laws. Control fleet expansion where this threatens the health or sustainability of any particular fishery. Maximise penalties and greatly improve enforcement of legislation on illegal and destructive fishing, fish farming, particularly where this damaged the environment.

A.A.ii. In cooperation with the industry, support research and investigations into the energy and capital costs of differing production systems. Encourage the adoption of gear, techniques, vessels, fish farm systems and processing technologies which are less costly in terms of fuel and capital inputs, and which are environmentally benign.

A.A.iii. Assist merchants, transport and retail operators to maximise fish distribution. Provide clean and hygienic premises for retail and wholesale markets. Improve storage and ice production. Lengthen shelf life of cured fish products through higher quality processing and better packing or storage. Introduce fish cookery in nutritional classes in school and support consumer groups or women's domestic organisations.

A.A.iv. Expand long-term preservation by canning and upgrade processing for export. Invest in local industry to produce packaging and processing components. Strengthen boat construction, shipbuilding and marine engineering, possibly through joint ventures or cooperation agreements with foreign partners. Support industrial training programmes for both managerial and technical staff.

Group B Strategies

The nine countries in group B have the potential to increase fish production and to develop their fishery industries substantially beyond present levels. Five of the nine have large and flourishing fisheries and in the other four the sector is less well developed. Although the demand for fish food is good in all except Iraq, the production potential is adequate to meet domestic needs and provide a surplus for export in each state except possibly Saudi Arabia. The development of offshore fishing fleets is a major requirement in Iran, Oman, United Arab Emirates and Papua New Guinea. Myanmar, Sri Lanka and Yemen have long had offshore or deep sea fleets though in Sri Lanka and Yemen the emphasis now is on the fleets of smaller wooden local vessels which have been consistently the most productive. Saudi Arabia probably has the best developed fish handling and marketing sector. Most others in the group need to invest in that part of the industry. Strategy suggestions for the group are:

B.S.i Develop long term integrated expansion plans for the FIS covering extraction, processing, marketing and support industry development.

B.S.ii Invest in necessary infrastructure, particularly fishing port and fish handling facilities and vessel repair/maintenance services.

B.S.iii Explore potential markets for fish products both among neighbouring countries and farther afield.

B.S.iv Secure foreign expertise or cooperation in expanding fleets, establishing new processing, plants and training personnel.

Group B - Relevant Activities

B.A.i Organise and stage national fish industry policy workshops involving industry (large and small scale), government, marine authorities, consumers, foreign buyers and UNIDO/FAO officials. Develop quantitative long term plans with specific goals and targets. Incorporate this in national policies and development plans. Seek and secure finance for investment capital and grant-aid technical assistance.

B.A.ii Determine infrastructural bottlenecks to FIS development. Investigate not cost-effective solutions to these and implement as part of national long-term plans for the sector. Involve industry in all deliberations and where possible allow private sector to invest in facilities.

B.A.iii Seek most appropriate added-value processing and markets for fish products. Invite and encourage foreign fish importers to work with local producers to meet long-term export market requirements. Liberalise trade legislation for processing inputs as well as for product export.

B.A.iv Encourage foreign cooperation on terms that prevent exploitation and maximise retention benefits for the country. Emphasize and insist on training for managerial and technical staff, transfer of technology and local assembly of machinery or components where possible. Facilitate contacts between prospective partners.

Group C Strategies

The countries of group C already have large and thriving fishery industries with a strong support-industry base. Their problems resemble those of the industrialised country fisheries, and in fact several of the group are already considered to be semi-industrialised and may soon be assumed to be developed rather than developing. Their fish industry strategies are therefore more likely to involve consolidation and further sophistication than establishment or expansion. They have the resources and ability if so desired to engage in joint ventures with other Asia/Pacific countries in processing or production. While they have strong domestic fish demand, financial earnings rather than food supply is the major focus of the industry. Strategies might include:

C.S.i Continue to ensure supplies by full development of national resources and by arrangements with other country fisheries in the region.

C.S.ii Maintain strength of processing sector by attention to economic and technical efficiency and development of additional added value products.

C.S.iii Upgrade cured fish products and by-products such as sauces, agar-agar, shark leather, etc. particularly for export markets.

C.S.iv Expand support industry to fisheries to include local manufacture of marine engines, electronic, hydraulic and refrigeration equipment and shipbuilding.

Group C Relevant Activities

C.A.i Protect coastal zones, encouraging mariculture and fish ranching, seaweed and shellfish farming. Control pollution and confer property rights on local coastal zone users. Control and spread offshore harvesting to ensure balanced and sustainable resource extraction. Secure supplies from neighbouring countries by joint-investment in capture fleets, culture systems and processing plants.

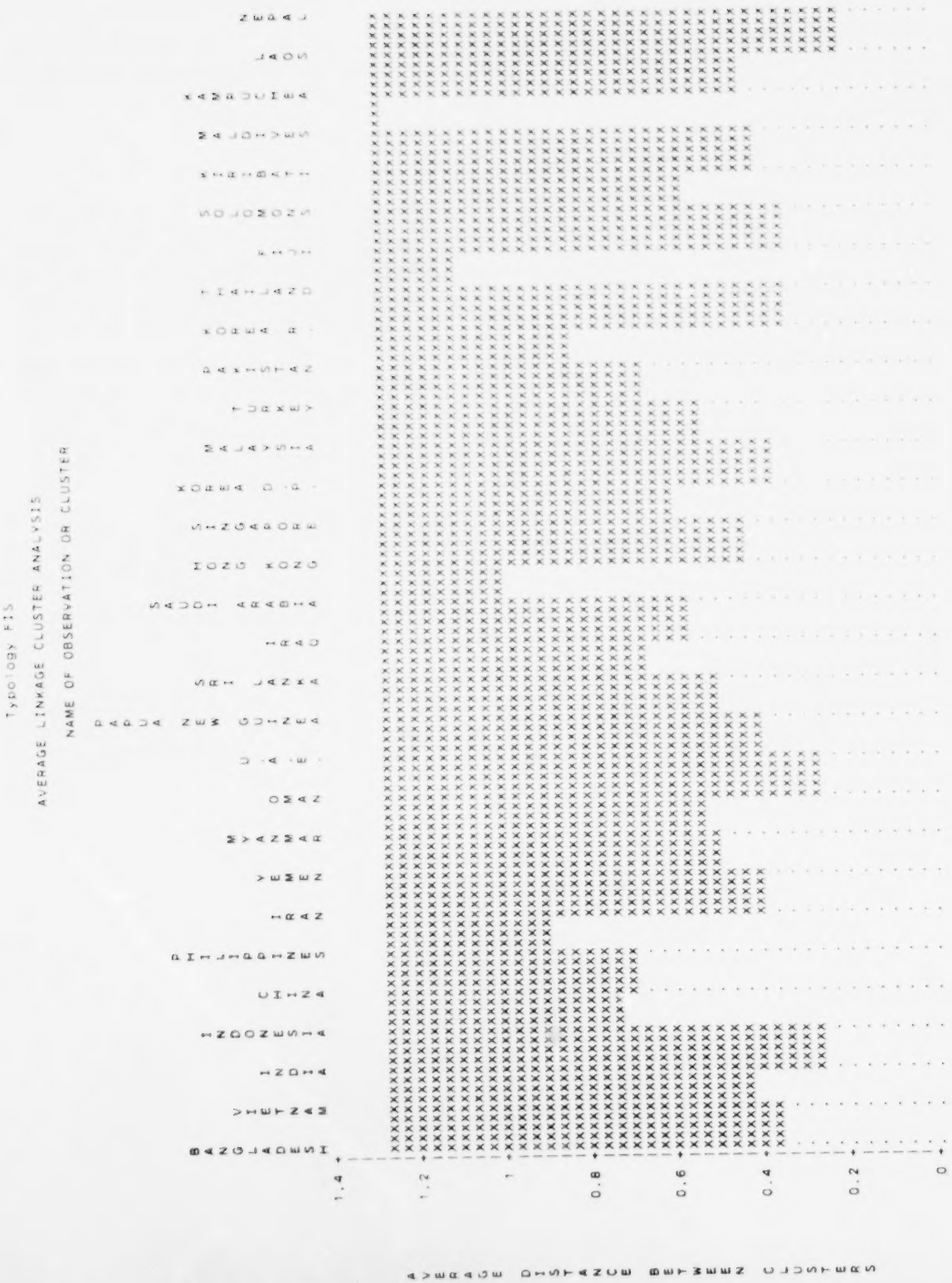
C.A.ii Monitor profitability and efficiency in the processing sector and upgrade with further mechanisation as labour costs rise beyond relevant capital costs. Develop further added-value products especially for export, in close consultation with foreign importers. Invest in product quality and image or consumer appeal.

C.A.iii Encourage the growth of speciality products or by-products from fish by building or traditional fish curing skills and targetting gourmet food and ethnic markets at home and abroad. Develop particular expertise in items of potential for further industry such as condiments from fish or seaweed and leather from sharkskin. Other food and chemical industry additives may also be extracted. Support research in this area.

C.A.iv Numerous foreign small- to medium-scale manufacturers are open to licensed or joint-venture assembly or manufacture of their equipment in other countries. Encourage such developments through use of trade fairs, industry consultations and tax or duty exemptions.

ANNEX I

Cluster Analysis Graphs



ANNEX I (continued)

Cluster Analysis Graphs

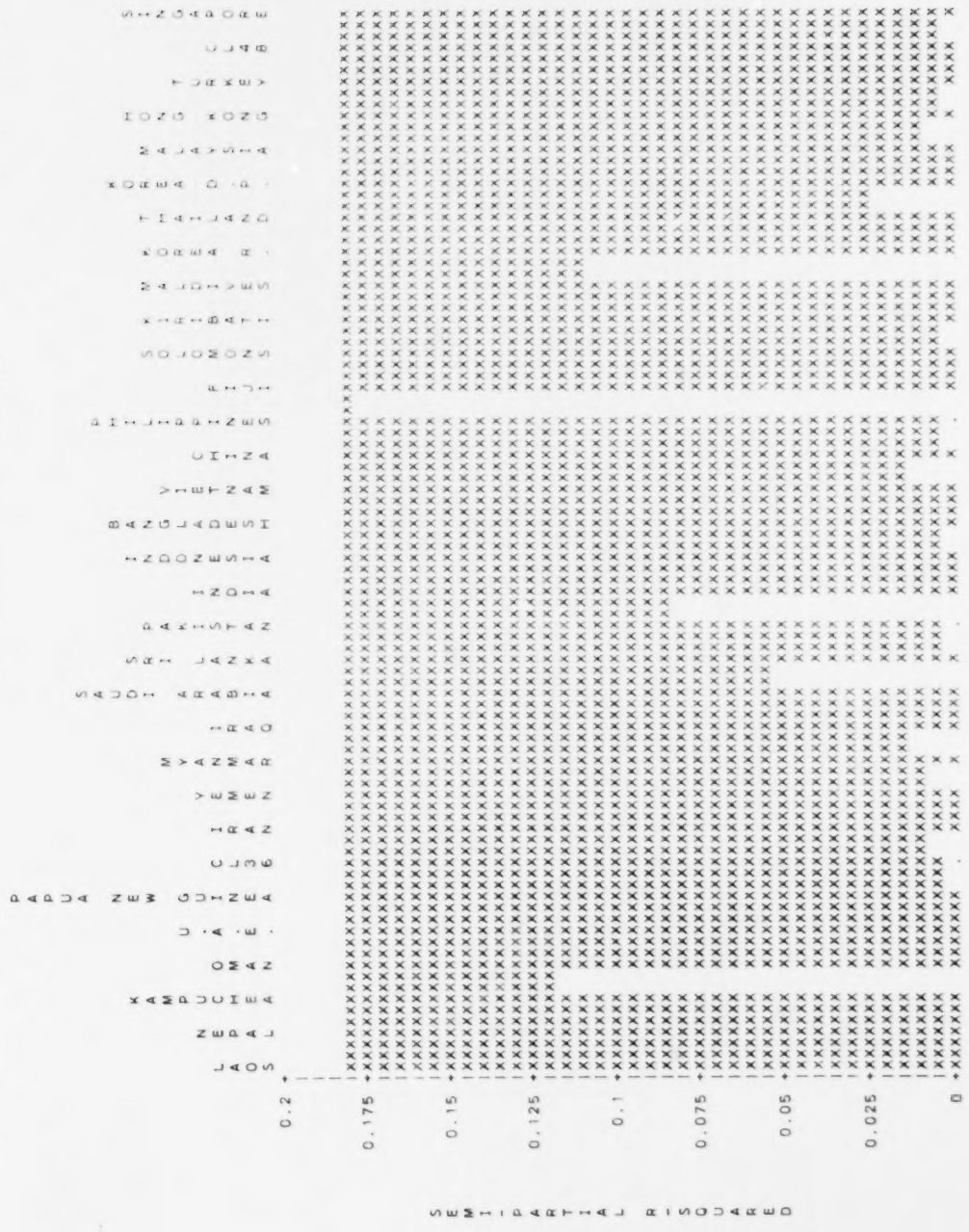
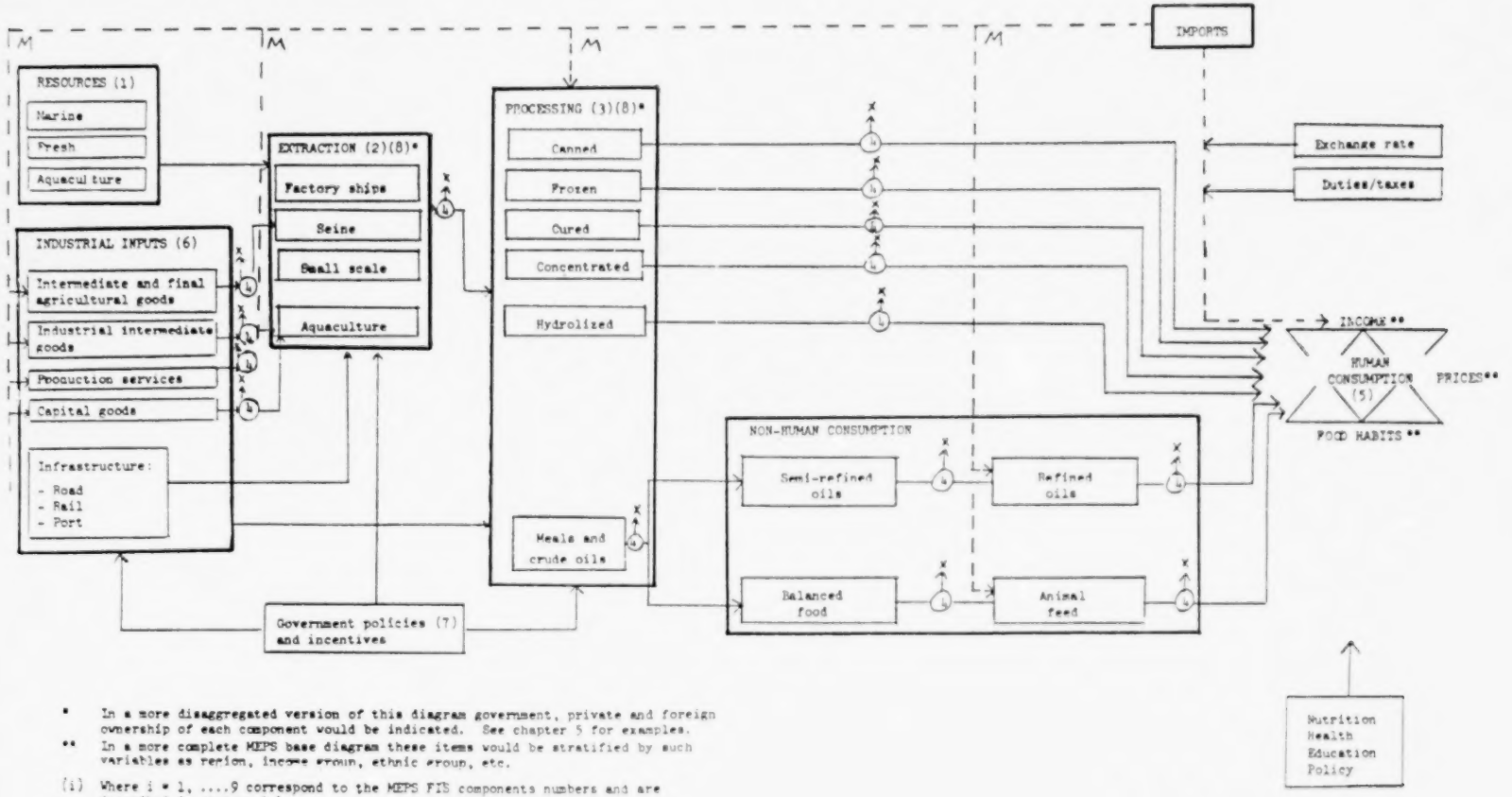


Figure 3.1. Base diagram for a FIS indicating the nine components and their linkages with the rest of the economy



* In a more disaggregated version of this diagram government, private and foreign ownership of each component would be indicated. See chapter 5 for examples.

** In a more complete MEPS base diagram these items would be stratified by such variables as region, income group, ethnic group, etc.

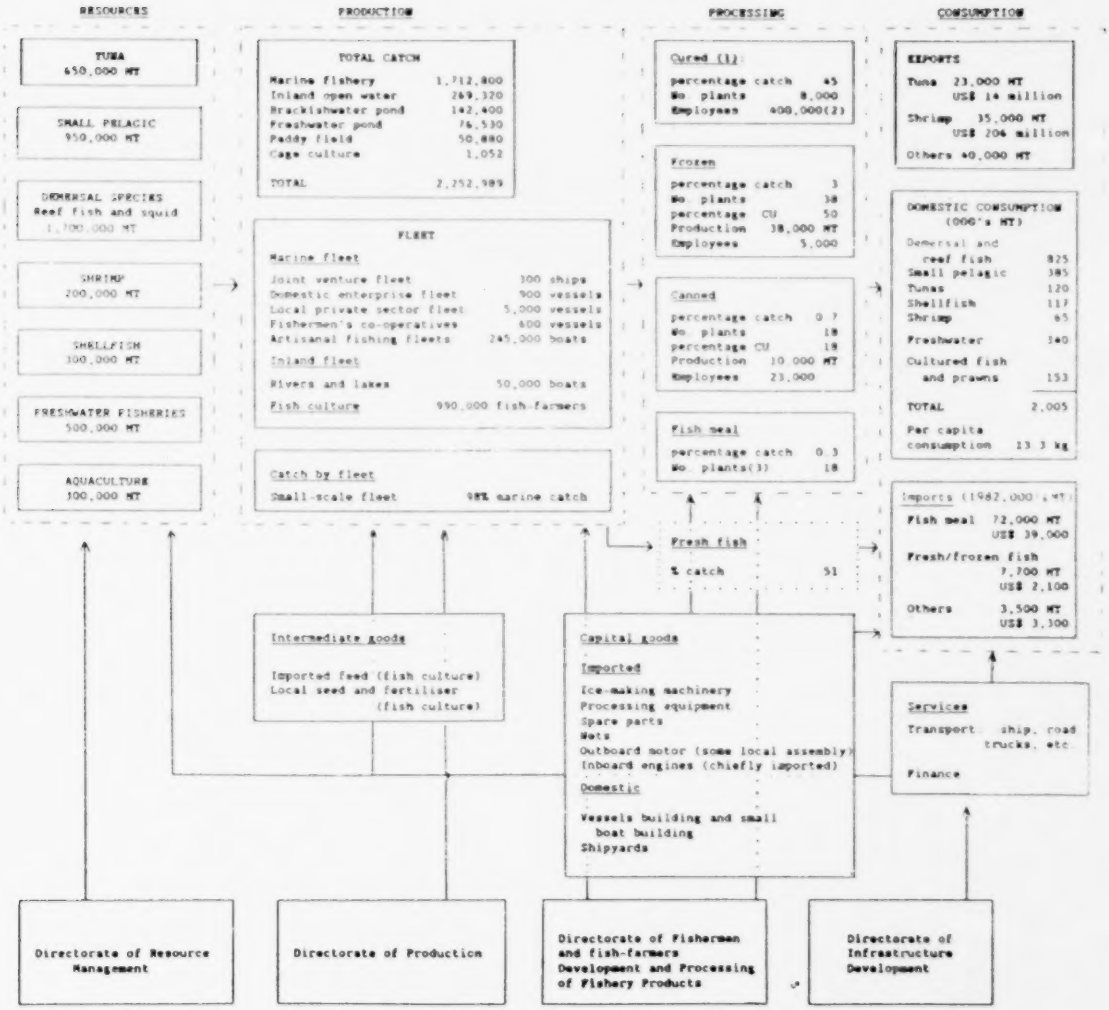
(i) Where i = 1, ...9 correspond to the MEPS FIS components numbers and are described in chapter 3.4

M = imports X = exports

ANNEX II (continued)

Base Diagrams

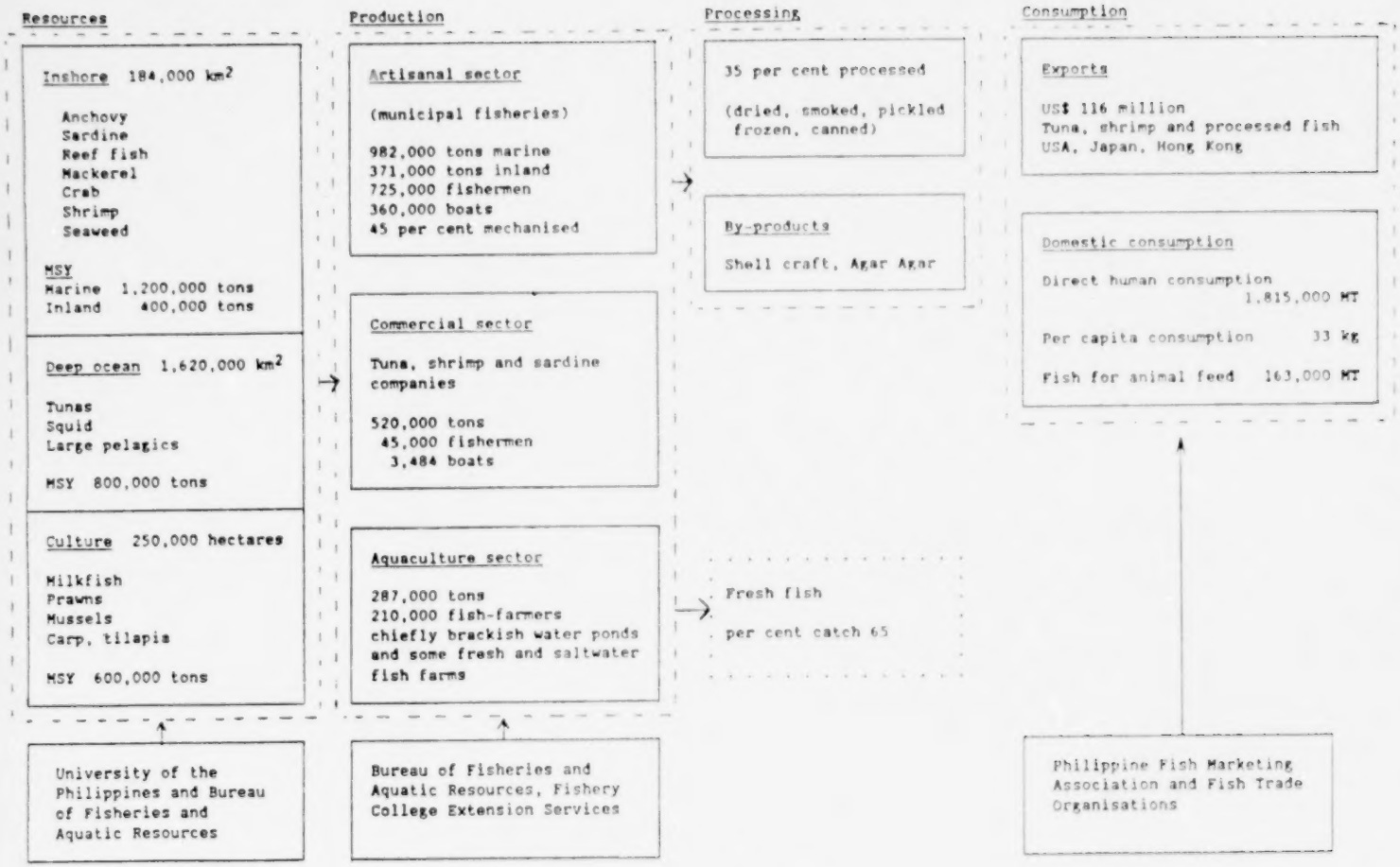
Figure 5.5. Base diagram FIS Indonesia 1984



ANNEX II (continued)

Base Diagrams

Figure 5.8. Base diagram FIS Philippines 1984



ANNEX III

ASIA AND PACIFIC - FISH FOOD BALANCE SHEETS
Averages for 1984-1986 (Figures somewhat rounded)
In Metric Tons Live Weight

Country or Area	Fish Catch	Non-Food Uses	Imports	Exports	Food Supply	Population in millions	Per caput supply kgs/year
World	87,170,000	26,625,300	13,204,400	13,658,100	60,340,000	4,854	12.4
Developed Countries	42,852,800	13,524,100	10,319,000	9,163,500	30,640,500	1,210	25.3
Developing Countries	44,317,200	13,101,200	2,885,600	4,494,500	29,699,000	3,644	8.1
N.West Asia	1,077,600	351,500	130,800	59,700	797,000	171	4.7
Iran	128,400	---	2,130	1,350	129,150	47.5	2.7
Iraq	21,000	---	---	---	21,000	15.9	1.3
Oman	100,880	56,000	2,750	20,290	27,400	1.2	22.1
Saudi Arabia	43,060	---	66,480	2,130	107,400	11.6	9.3
Turkey	577,630	220,200	175	26,950	330,670	50.3	6.6
United Arab Emirates	72,600	52,400	12,120	1,400	30,960	1.4	22.8
Yemen*	107,200	23,000	4,860	5,500	83,000	9.0	9.2
S. Asia	4,290,200	403,010	62,330	244,120	3,711,400	1,008	3.7
Bangladesh	772,800	---	---	22,340	750,480	101.2	7.4
India	2,870,420	230,630	---	125,590	2,514,200	769.0	3.3
Maldives	58,740	7,330	---	36,620	14,780	0.18	80.8

* Combined totals of North and South Yemen before unification.

Source: FAO.

ANNEX III (continued)

ASIA AND PACIFIC - FISH FOOD BALANCE SHEETS

Country or Area	Fish Catch	Non-Food Uses	Imports	Exports	Food Supply	Population in millions	Per caput supply kgs/year
Nepal	7,790	---	---	---	7,790	16.9	0.5
Pakistan	404,300	164,420	12	56,780	189,610	103.1	1.8
Sri Lanka	175,110	610	63,320	5,790	233,510	16.1	14.5
S.E. Asia	11,840,830	1,188,920	1,040,660	2,119,760	9,634,110	399.1	24.6
Hong Kong	203,830	12,760	205,700	145,480	251,870	5.5	46.1
Indonesia	2,370,720	12,720	5,880	102,190	2,268,530	166.4	13.6
Korea Rep.	2,742,210	100,290	116,030	660,620	2,098,920	41.0	51.1
Laos	20,000	---	---	---	20,000	3.6	5.6
Malaysia	638,080	110,230	246,650	208,500	566,020	15.5	36.6
Myanmar	626,070	20,000	---	8,460	597,610	37.5	15.9
Philippines	1,907,370	---	14,800	72,100	1,837,220	55.1	33.7
Singapore	23,000	12,890	197,090	102,280	104,170	2.6	40.7
Thailand	2,298,800	915,150	220,950	501,650	1,113,070	51.6	21.6
China	6,901,893	265,000	18,775	252,406	6,403,262	1,041	6.1
Asian CPE	2,533,040	809,760	1,680	62,450	1,662,710	89.6	18.6
Kampuchea	67,670	---	---	---	67,670	7.3	9.3
Korea DP Rep.	1,683,330	809,760	---	32,540	841,030	20,390	41.3
Viet Nam	782,670	---	---	29,910	751,750	60,070	12.5
Oceania	142,790	29,900	87,850	58,810	145,920	5.6	26.1
Fiji	28,420	3,290	15,790	8,360	32,370	0.7	46.9
Papua N Guin	11,130	---	55,980	5,100	64,000	3.5	18.2
Solomon Is	49,800	140	1,950	36,590	16,100	0.3	59.9